INFORMATION TECHNOLOGY-NETWORKING STANDARDS

This document was prepared by:

Office of Career, Technical and Adult Education
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CTE MISSION STATEMENT:

The Office of Career, Technical and Adult Education is dedicated to developing innovative educational opportunities for students to acquire skills for productive employment and lifelong learning.

NEVADA DEPARTMENT OF EDUCATION

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BUSINESS AND INDUSTRY VALIDATION

All CTE standards developed through the Nevada Department of Education are validated by business and industry through one or more of the following processes: (1) the standards are developed by a team consisting of business and industry representatives; or (2) a separate review panel was coordinated with industry experts to ensure the standards include the proper content; or (3) the adoption of nationally-recognized standards endorsed by business and industry.

The Information Technology-Networking standards were validated with the adoption of nationally recognized standards by CISCO, Inc.

PROJECT COORDINATOR

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INTRODUCTION

The standards in this document are designed to clearly state what the student should know and be able to do upon completion of an advanced high school Information Technology – Networking program. These standards are designed for a three-credit course sequence that prepares the student for a technical assessment directly aligned to the standards.

These exit-level standards are designed for the student to complete all standards through their completion of a program of study. These standards are intended to guide curriculum objectives for a program of study.

The standards are organized as follows:

Content Standards are general statements that identify major areas of knowledge, understanding, and the skills students are expected to learn in key subject and career areas by the end of the program.

Performance Standards follow each content standard. Performance standards identify the more specific components of each content standard and define the expected abilities of students within each content standard.

Performance Indicators are very specific criteria statements for determining whether a student meets the performance standard. Performance indicators may also be used as learning outcomes, which teachers can identify as they plan their program learning objectives.

The crosswalk and alignment section of the document shows where the performance indicators support the English Language Arts and the Mathematics Common Core State Standards, and the Nevada State Science Standards. Where correlation with an academic standard exists, students in the Information Technology – Networking program perform learning activities that support, either directly or indirectly, achievement of one or more Common Core State Standards.

All students are encouraged to participate in the career and technical student organization (CTSO) that relates to their program area. CTSOs are co-curricular national associations that directly enforce learning in the CTE classroom through curriculum resources, competitive events, and leadership development. CTSOs provide students the ability to apply academic and technical knowledge, develop communication and teamwork skills, and cultivate leadership skills to ensure college and career readiness.

The Employability Skills for Career Readiness identify the “soft skills” needed to be successful in all careers, and must be taught as an integrated component of all CTE course sequences. These standards are available in a separate document.

CONTENT STANDARD 1.0 : IDENTIFY AND UTILIZE SAFETY PROCEDURES AND PROPER TOOLS	
PERFORMANCE STANDARD 1.1 : IDENTIFY AND UTILIZE SAFETY PROCEDURES	
1.1.1	Define industry standard vocabulary
1.1.2	Define safety procedures and potential hazards
1.1.3	Identify and implement safety procedures to protect equipment from damage and data loss
1.1.4	Identify and implement safety procedures to protect the environment from contamination
1.1.5	Interpret Material Safety Data Sheets (MSDS)
PERFORMANCE STANDARD 1.2 : IDENTIFY AND UTILIZE PROPER TOOLS	
1.2.1	Identify industry standard tools
1.2.2	Demonstrate the proper use, care and storage of test equipment
1.2.3	Demonstrate the proper use, care and storage of diagnostic tools
1.2.4	Demonstrate the proper use, care and storage of hand tools
1.2.5	Utilize appropriate documentation methods and procedures

CONTENT STANDARD 2.0 : EXAMINE NETWORK SYSTEM HARDWARE	
PERFORMANCE STANDARD 2.1 : IDENTIFY NETWORK HARDWARE	
2.1.1	Define industry standard vocabulary
2.1.2	Analyze and describe networking interfaces
2.1.3	Identify internetworking equipment (i.e., hubs, repeaters, etc.)
2.1.4	Identify various networking topologies
2.1.5	Differentiate various network transmission media
2.1.6	Demonstrate proper cabling techniques
2.1.7	Discuss signal degradation
2.1.8	Construct a network utilizing layer one devices
PERFORMANCE STANDARD 2.2 : EXAMINE BRIDGES AND SWITCHES	
2.2.1	Identify bridges and switches
2.2.2	Describe industry standard ports
2.2.3	Demonstrate how bridges and switches augment network topologies
2.2.4	Explore Media Access Control (MAC) in network design
2.2.5	Construct a network utilizing layer two devices
PERFORMANCE STANDARD 2.3 : EXPLORE ROUTERS	
2.3.1	Analyze and describe industry standard router interfaces
2.3.2	Research the purpose of routers
2.3.3	Compare and contrast computers and routers
2.3.4	Relate routers and the network layers
2.3.5	Model router configurations
2.3.6	Construct a network utilizing layer three devices
PERFORMANCE STANDARD 2.4 : INVESTIGATE WIRELESS NETWORKS	
2.4.1	Identify wireless devices
2.4.2	Differentiate industry standard wireless technologies
2.4.3	Diagram various wireless network topologies
2.4.4	Construct a network utilizing wireless layer two devices

CONTENT STANDARD 3.0 : ANALYZE SYSTEM NETWORK PROTOCOLS

PERFORMANCE STANDARD 3.1 : IDENTIFY PROTOCOLS

3.1.1	Define industry standard vocabulary
3.1.2	Characterize the Open Systems Interconnection (OSI) model in terms of internetworking equipment and protocols
3.1.3	Identify and explain Internet Protocol (IP)
3.1.4	Identify and explain routing protocols (i.e., RIP, EIGRP, OSPF, PPP, etc.)
3.1.5	Compare and contrast distance vector and link-state protocols
3.1.6	Identify and explain switching protocols (i.e., STP, VTP, RSTP, VLAN, PVSTP, 802.1q, etc.)

PERFORMANCE STANDARD 3.2 : UTILIZE PROTOCOLS

3.2.1	Demonstrate the configuration of various network protocols
3.2.2	Describe the purpose of a password
3.2.3	Identify and formulate Binary and Decimal numbers
3.2.4	Implement a classful IPv4 subnet schema
3.2.5	Implement a variable length IPv4 subnet schema
3.2.6	Implement a Classless Inter-Domain Routing Protocol (CIDR)

PERFORMANCE STANDARD 3.3 : IDENTIFY SECURITIES POLICIES AND PROCEDURES

3.3.1	Research the need for network security
3.3.2	Evaluate threats to network security
3.3.3	Describe the purpose of an access control list (i.e., firewall)
3.3.4	Explain proper password implementation
3.3.5	Investigate user and group accounts
3.3.6	Investigate user and group security policies

CONTENT STANDARD 4.0 : CONSTRUCT NETWORK SYSTEMS	
PERFORMANCE STANDARD 4.1 : IDENTIFY NETWORK SYSTEM NEEDS	
4.1.1	Identify and describe the benefits of the hierarchical network model
4.1.2	Define the acronyms for telecommunications (i.e., VoIP, PBX, etc.)
4.1.3	Perform a customer network needs assessment
4.1.4	Analyze the network needs assessment
4.1.5	Evaluate the physical and logical topology considerations
PERFORMANCE STANDARD 4.2 : DESIGN AND EVALUATE NETWORK SYSTEMS	
4.2.1	Choose and implement the appropriate network solution (peer-to-peer vs. client-server)
4.2.2	Design and evaluate networks
4.2.3	Utilize network addressing (i.e., MAC, IPv4, IPv6, etc.)
4.2.4	Diagram the network infrastructure (i.e., cable, addressing, etc.)
4.2.5	Explain factors that enhance a network's throughput
4.2.6	Critique final network designs
PERFORMANCE STANDARD 4.3 : CONSTRUCT NETWORK SYSTEMS	
4.3.1	Construct Local Area Networks (LAN) utilizing network designs
4.3.2	Construct Wide Area Networks (WAN) using multiple Local Area Networks (LAN)
4.3.3	Configure wireless devices (i.e., wireless access points, bridges, etc.)
PERFORMANCE STANDARD 4.4 : PERFORM NETWORK ADMINISTRATION AND MONITORING	
4.4.1	Create a network baseline
4.4.2	Diagram and update changes to the physical and logical topologies
4.4.3	Describe common issues that occur during network administration and monitoring
4.4.4	Utilize diagnostics tools to validate the interconnectivity of network designs (i.e., Ping, Tracert, Netstat, Nslookup, etc.)
4.4.5	Utilize IOS diagnostics tools to validate the interconnectivity of network designs (i.e., show interfaces, show MAC address tables, etc.)

CONTENT STANDARD 5.0 : MAINTAIN NETWORK SYSTEMS	
PERFORMANCE STANDARD 5.1 : DEMONSTRATE NETWORK TROUBLESHOOTING AND DIAGNOSTICS	
5.1.1	Describe the stages of network documentation processes
5.1.2	Describe the layered models on how they are used for troubleshooting
5.1.3	Investigate and diagnose network failures
5.1.4	Troubleshoot and repair common network failures
5.1.5	Demonstrate password implementation and recovery
5.1.6	Utilize diagnostic tools
PERFORMANCE STANDARD 5.2 : DEMONSTRATE NETWORK MAINTENANCE	
5.2.1	Install and configure firewall services
5.2.2	Install and update anti-virus software
5.2.3	Develop a routine maintenance plan
5.2.4	Document network diagrams at both LAN and WAN
5.2.5	Revise network design for scalability and maintainability

CROSSWALK AND ALIGNMENTS OF INFORMATION TECHNOLOGY - NETWORKING STANDARDS AND THE COMMON CORE STATE STANDARDS, THE NEVADA SCIENCE STANDARDS, AND THE COMMON CAREER TECHNICAL CORE STANDARDS

CROSSWALK (ACADEMIC STANDARDS)

The crosswalk of the Information Technology-Networking Standards shows links to the Common Core State Standards for English Language Arts and Mathematics and the Nevada Science Standards. The crosswalk identifies the performance indicators in which the learning objectives in the Information Technology-Networking program support academic learning. The performance indicators are grouped according to their content standard and are crosswalked to the English Language Arts and Mathematics Common Core State Standards and the Nevada Science Standards.

ALIGNMENTS (MATHEMATICAL PRACTICES)

In addition to correlation with the Common Core Mathematics Content Standards, many performance indicators support the Common Core Mathematical Practices. The following table illustrates the alignment of the Information Technology-Networking Standards Performance Indicators and the Common Core Mathematical Practices. This alignment identifies the performance indicators in which the learning objectives in the Information Technology -Networking program support academic learning.

CROSSWALK (COMMON CAREER TECHNICAL CORE)

The crosswalk of the Information Technology-Networking Standards shows links to the Common Career Technical Core. The crosswalk identifies the performance indicators in which the learning objectives in the Information Technology-Networking program support the Common Career Technical Core. The Common Career Technical Core defines what students should know and be able to do after completing instruction in a program of study. The Information Technology-Networking Standards are crosswalked to the Information Technology Career Cluster™ and the Network Systems Career Pathway.

CROSSWALK OF INFORMATION TECHNOLOGY – NETWORKING STANDARDS AND THE COMMON CORE STATE STANDARDS

CONTENT STANDARD 1.0: IDENTIFY AND UTILIZE SAFETY PROCEDURES AND PROPER TOOLS

Performance Indicators	Common Core State Standards and Nevada Science Standards
1.1.2	**English Language Arts: Reading Standards for Literacy in Science and Technical Subjects** RST.11-12.4 Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to grades 11–12 texts and topics. RST.11-12.9 Synthesize information from a range of sources (e.g., texts, experiments, simulations) into a coherent understanding of a process, phenomenon, or concept, resolving conflicting information when possible. **English Language Arts: Writing Standards for Literacy in Science and Technical Subjects** WHST.11-12.4 Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience.
1.1.5	**English Language Arts: Reading Standards for Literacy in Science and Technical Subjects** RST.11-12.4 Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to grades 11–12 texts and topics. **English Language Arts: Writing Standards for Literacy in Science and Technical Subjects** WHST.11-12.9 Draw evidence from informational texts to support analysis, reflection, and research.
1.2.5	**English Language Arts: Writing Standards for Literacy in Science and Technical Subjects** WHST.11-12.4 Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience.

CONTENT STANDARD 2.0: EXAMINE NETWORK SYSTEM HARDWARE

Performance Indicators	Common Core State Standards and Nevada Science Standards
2.1.2	**English Language Arts: Reading Standards for Literacy in Science and Technical Subjects** RST.11-12.4 Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to grades 11–12 texts and topics. **English Language Arts: Writing Standards for Literacy in Science and Technical Subjects** WHST.11-12.4 Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience.
2.1.7	**English Language Arts: Speaking and Listening Standards** SL.11-12.2 Integrate multiple sources of information presented in diverse formats and media (e.g., visually, quantitatively, orally) in order to make informed decisions and solve problems, evaluating the credibility and accuracy of each source and noting any discrepancies among the data. SL.11-12.4 Present information, findings, and supporting evidence, conveying a clear and distinct perspective, such that listeners can follow the line of reasoning, alternative or opposing perspectives are addressed, and the organization, development, substance, and style are appropriate to purpose, audience, and a range of formal and informal tasks.
2.3.1	**English Language Arts: Reading Standards for Literacy in Science and Technical Subjects** RST.11-12.4 Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to grades 11–12 texts and topics. RST.11-12.9 Synthesize information from a range of sources (e.g., texts, experiments, simulations) into a coherent understanding of a process, phenomenon, or concept, resolving conflicting information when possible. **English Language Arts: Writing Standards for Literacy in Science and Technical Subjects** WHST.11-12.4 Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience.
2.3.2	**English Language Arts: Reading Standards for Literacy in Science and Technical Subjects** RST.11-12.6 Analyze the author's purpose in providing an explanation, describing a procedure, or discussing an experiment in a text, identifying important issues that remain unresolved. RST.11-12.8 Evaluate the hypotheses, data, analysis, and conclusions in a science or technical text, verifying the data when possible and corroborating or challenging conclusions with other sources of information. **English Language Arts: Writing Standards for Literacy in Science and Technical Subjects** WHST.11-12.7 Conduct short as well as more sustained research projects to answer a question (including a self-generated question) or solve a problem; narrow or broaden the inquiry when appropriate; synthesize multiple sources on the subject, demonstrating understanding of the subject under investigation. WHST.11-12.9 Draw evidence from informational texts to support analysis, reflection, and research.
2.3.3	**English Language Arts: Writing Standards for Literacy in Science and Technical Subjects** WHST.11-12.4 Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience.
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CONTENT STANDARD 3.0: ANALYZE SYSTEM NETWORK PROTOCOLS

Performance Indicators	Common Core State Standards and Nevada Science Standards
3.1.3	**English Language Arts: Reading Standards for Literacy in Science and Technical Subjects** RST.11-12.4 Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to grades 11–12 texts and topics. **English Language Arts: Writing Standards for Literacy in Science and Technical Subjects** WHST.11-12.4 Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience.
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3.3.2	**English Language Arts: Reading Standards for Literacy in Science and Technical Subjects** RST.11-12.7 Integrate and evaluate multiple sources of information presented in diverse formats and media (e.g., quantitative data, video, multimedia) in order to address a question or solve a problem.

3.3.3	**English Language Arts: Reading Standards for Literacy in Science and Technical Subjects** RST.11-12.4 Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to grades 11–12 texts and topics. **English Language Arts: Writing Standards for Literacy in Science and Technical Subjects** WHST.11-12.4 Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience.
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CONTENT STANDARD 4.0: CONSTRUCT NETWORK SYSTEMS

Performance Indicators	Common Core State Standards and Nevada Science Standards
4.1.1	**English Language Arts: Reading Standards for Literacy in Science and Technical Subjects** RST.11-12.9 Synthesize information from a range of sources (e.g., texts, experiments, simulations) into a coherent understanding of a process, phenomenon, or concept, resolving conflicting information when possible. **English Language Arts: Writing Standards for Literacy in Science and Technical Subjects** WHST.11-12.4 Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience.
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4.4.2	**English Language Arts: Reading Standards for Literacy in Science and Technical Subjects** RST.11-12.4 Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to grades 11–12 texts and topics. **English Language Arts: Writing Standards for Literacy in Science and Technical Subjects** WHST.11-12.4 Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience.
4.4.3	**English Language Arts: Reading Standards for Literacy in Science and Technical Subjects** RST.11-12.5 Analyze how the text structures information or ideas into categories or hierarchies, demonstrating understanding of the information or ideas. **English Language Arts: Writing Standards for Literacy in Science and Technical Subjects** WHST.11-12.4 Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience.

CONTENT STANDARD 5.0: MAINTAIN NETWORK SYSTEMS

Performance Indicators	Common Core State Standards and Nevada Science Standards
5.1.1	**English Language Arts: Reading Standards for Literacy in Science and Technical Subjects** RST.11-12.4 Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to grades 11–12 texts and topics. RST.11-12.9 Synthesize information from a range of sources (e.g., texts, experiments, simulations) into a coherent understanding of a process, phenomenon, or concept, resolving conflicting information when possible. **English Language Arts: Writing Standards for Literacy in Science and Technical Subjects** WHST.11-12.4 Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience.
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ALIGNMENT OF INFORMATION TECHNOLOGY – NETWORKING STANDARDS AND THE COMMON CORE MATHEMATICAL PRACTICES

Common Core Mathematical Practices	Information Technology – Networking Performance Indicators
1. Make sense of problems and persevere in solving them.	
2. Reason abstractly and quantitatively.	
3. Construct viable arguments and critique the reasoning of others.	
4. Model with mathematics.	
5. Use appropriate tools strategically.	1.2.2, 1.2.3; 5.1.6
6. Attend to precision.	1.2.2, 1.2.3; 3.2.3
7. Look for and make use of structure.	
8. Look for and express regularity in repeated reasoning.	

CROSSWALKS OF INFORMATION TECHNOLOGY-NETWORKING STANDARDS AND THE COMMON CAREER TECHNICAL CORE

Information Technology Career Cluster™ (IT)	Performance Indicators
1. Demonstrate effective professional communication skills and practices that enable positive customer relationships.	
2. Use product or service design processes and guidelines to produce a quality information technology (IT) product or service.	3.1.3-3.1.6; 3.2.1-3.2.6 4.1.1-4.1.5; 4.2.1-4.2.6 4.3.1-4.3.3
3. Demonstrate the use of cross-functional teams in achieving IT project goals.	
4. Demonstrate positive cyber citizenry by applying industry accepted ethical practices and behaviors.	1.1.1-1.1.5; 1.2.1-1.2.5
5. Explain the implications of IT on business development.	
6. Describe trends in emerging and evolving computer technologies and their influence on IT practices.	
7. Perform standard computer backup and restore procedures to protect IT information.	
8. Recognize and analyze potential IT security threats to develop and maintain security requirements.	3.3.1-3.3.6
9. Describe quality assurance practices and methods employed in producing and providing quality IT products and services.	4.4.1-4.4.5
10. Describe the use of computer forensics to prevent and solve information technology crimes and security breaches.	
11. Demonstrate knowledge of the hardware components associated with information systems.	2.1.1-2.1.8; 2.2.1-2.2.5 2.3.1-2.3.6; 2.4.1-2.4.4
12. Compare key functions and applications of software and determine maintenance strategies for computer systems.	5.1.1-5.1.6; 5.2.1-5.2.5

Network Systems Career Pathway (IT-NET)	Performance Indicators
1. Analyze customer or organizational network system needs and requirements.	4.1.1-4.1.5
2. Analyze wired and wireless network systems to determine if they meet specifications (e.g., IEEE, power, security).	2.4.1-2.4.4
3. Design a network system using technologies, tools and standards.	2.1.1-2.1.8; 2.2.5; 2.3.5 2.3.6; 4.2.1-4.2.6
4. Perform network system installation and configuration.	3.2.1-3.2.6; 4.3.1-4.3.3
5. Perform network administration, monitoring and support to maintain a network system.	4.4.1-4.4.5 5.1.1-5.1.6; 5.2.1-5.2.5